



GUIDE FOR

**AUTOMATIC OR REMOTE CONTROL AND
MONITORING FOR MACHINERY AND SYSTEMS
(OTHER THAN PROPULSION) ON OFFSHORE
INSTALLATIONS**

MARCH 2003 (Updated October 2008 – see next page)

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Incorporated by Act of Legislature of
The State of New York 1862**

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Updates

October 2008 consolidation includes:

- March 2003 version plus Notice No. 1, Corrigenda/Editorials

Foreword

This Guide has been prepared to assist the industry to obtain the optional classification notations relative to the automatic or remote control and monitoring systems for the machinery and systems on offshore installations. This Guide is intended to apply to the automatic or remote control and monitoring systems for non propulsion related machinery and systems on offshore floating installations or fixed installations.

In association with the Bureau's current **ACC** and **ACCU** notations applicable to the automatic or remote control and monitoring systems for propulsion machinery and propulsion associated auxiliary machinery on a vessel, this Guide with **AMCC** and **AMCCU** notations will cover the automatic or remote control and monitoring of the machinery and systems not associated with propulsion. This Guide is applicable to the controls and monitoring systems of the machinery and systems, other than propulsion related machinery, as listed in Subsection 1/1 of this Guide, when the optional Class notation **AMCC** or **AMCCU** is requested.

Where, in lieu of manning the machinery space(s) locally, it is intended to control and monitor the machinery under continuous supervision from a local centralized control and monitoring station(s) located within or adjacent to the machinery space(s), a class notation **AMCC** will be assigned. Where it is intended that the machinery space(s) and the local centralized control and monitoring station(s) (if provided) be periodically unmanned and that the machinery be controlled and monitored from a remote control and monitoring center located outside the machinery space(s), a Class notation **AMCCU** will be assigned.

This Guide becomes effective immediately upon publication.

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GUIDE FOR
Automatic or Remote Control and Monitoring for Machinery and Systems (other than Propulsion) on Offshore Installations

CONTENTS

SECTION 1	General	5
1	Application and Scope	5
3	Optional Classification Notations	5
3.1	AMCC	5
3.3	AMCCU	6
3.5	Periodical Survey	6
5	Definitions	6
5.1	Alarm.....	6
5.3	Control	6
5.5	Control System.....	6
5.7	Automatic Control.....	6
5.9	Instrumentation	6
5.11	Local Control	6
5.13	Remote Control	6
5.15	Monitoring System	6
5.17	Safety System	7
5.19	Fail-safe	7
5.21	Systems Independence.....	7
5.23	Unmanned Machinery Space.....	7
5.25	Local Centralized Control and Monitoring Station	7
5.27	Remote Control and Monitoring Center.....	7
7	Plans and Data	7
7.1	Specifications	7
7.3	System Design Plans	7
7.5	Control Console Plans	8
7.7	Installation Plans.....	8
9	General Provisions.....	8
9.1	Alarm Systems	8
9.3	Automatic Safety Shutdown	9
9.5	Power Supply	10
9.7	Fail-safe	11

9.9	Local Controls	11
9.11	Control Transfer	11
9.13	Components	11
9.15	Installation	12
9.17	Testing.....	12

TABLE 1	Electrical Variations	11
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SECTION 2 AMCC Notation..... 13

1	Application	13
3	Local Centralized Control and Monitoring Station(s)	13
5	Monitoring in Local Centralized Control Station(s)	13
7	Engineer's Alarm.....	13
9	Instrumentation of Machinery	13
9.1	Oil Fired Boilers.....	13
9.3	Incinerators.....	15
9.5	Waste Heat Boilers.....	15
9.7	Fired Water Heaters	16
9.9	Fired Thermal Oil Heaters	16
9.11	Exhaust Gas Thermal Oil Heaters	17
9.7	Crude Oil or Slops Burning Boilers	17
9.15	Inert Gas System.....	18
9.17	Steam Turbines	19
9.19	Gas Turbines.....	20
9.21	Diesel Engines	21
9.23	Hazardous Liquid Handling Machinery/Systems	21
9.25	Use of Cargo as Fuel	22
9.27	Electric Power Generating Plant.....	23
9.29	Fuel Oil System	24
11	Machinery Space Monitoring	24
11.1	Bilge Level and Fire Monitoring	24

TABLE 1	Oil Fired Boilers.....	14
TABLE 2	Incinerators	15
TABLE 3	Waste Heat Boilers	15
TABLE 4	Fired Water Heaters.....	16
TABLE 5	Fired Thermal Oil Heaters.....	16
TABLE 6	Exhaust-gas Thermal Oil Heaters.....	17
TABLE 7	Crude Oil or Slops Burning Boilers	17
TABLE 8	Inert Gas Generators	18
TABLE 9	Nitrogen Generator Inert Gas System	19
TABLE 10	Steam Turbines.....	19
TABLE 11	Gas Turbines.....	20
TABLE 12	Diesel Engines	21
TABLE 13	Ballast Machinery/Systems in Pump Room.....	21

TABLE 14	Cargo Machinery/Systems	22
TABLE 15	Cargo as Fuel	22
TABLE 16	Gas fired Internal Combustion Engine	23
TABLE 17	Electric Power Generating Plant	23
TABLE 18	Fuel Oil Systems	24
TABLE 19	Bilge and Fire Systems	24

SECTION 3	AMCCU Notation	25
1	Application	25
3	Duration of Unattended Operation	25
5	Remote Control and Monitoring Center	25
7	Monitoring Station in the Engineers' Quarters	25
9	Fire Fighting Station	25
11	Fire Detection and Alarm Systems	26
	11.1 General	26
	11.3 Fire Alarm Call Points	26
13	Interior Communication System	26

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SECTION 1 General

1 Application and Scope

This Guide is intended to be used exclusively for the automatic and remote controls and monitoring of machinery and systems not related to propulsion installed on fixed or floating offshore vessels. The optional classification notations **AMCC** and **AMCCU** do not cover the instrumentation and control systems for the hydrocarbon production and process system or the automatic or remote control of the propulsion machinery/systems. They are specified in Chapter 3, Section 7 of the *ABS Guide for Building and Classing Facilities on Offshore Installations (Facilities Guide)* and Part 4, Section 9 of the *ABS Rules for Building and Classing Steel Vessels (Steel Vessel Rules)*, respectively.

This Guide applies to controls and monitoring of the following machinery/systems (not related to propulsion), as applicable, where the optional Class notation **AMCC** or **AMCCU** is requested:

- Diesel engines
- Steam turbines
- Gas turbines
- Oil fired boilers
- Crude oil or slops or methane gas burning boilers
- Electric power generating plants
- Exhaust gas thermal oil heaters
- Fired thermal oil heaters
- Gas fired internal combustion engines
- Hazardous liquid handling machinery/systems
- Incinerators
- Inert gas generators
- Nitrogen generators
- Waste heat boilers
- Fuel oil systems

3 Optional Classification Notations

3.1 AMCC

Where, in lieu of manning the machinery space(s) locally, it is intended to control and monitor the machinery/systems, as listed in Subsection 1/1, under continuous supervision from a local centralized control and monitoring station(s), the provisions of Subsection 1/9 and Section 2 are to be complied with. The Class notation **AMCC** will be assigned upon verification of compliance and upon satisfactory tests carried out in accordance with the provision of 1/9.17.

3.3 AMCCU

Where it is intended that the machinery space(s) and the local centralized control and monitoring station(s) (if provided) be periodically unmanned, and that the machinery/systems, as listed in Subsection 1/1, be controlled and monitored from a remote control and monitoring center located outside the machinery space(s), the provisions of Subsection 1/9, Section 2 and Section 3 are to be complied with. The Class notation **AMCCU** will be assigned upon verification of compliance and upon satisfactory tests carried out in accordance with the provision of 1/9.17.

3.5 Periodical Survey

The continuance of validity of these notations is subject to periodical survey of the Automatic or Remote Control and Monitoring for Machinery/Systems as specified in Chapter 9, Section 12 of the *Guide for Building and Classing Floating Production Installations*.

5 Definitions

5.1 Alarm

Visual and audible signals indicating an abnormal condition of a monitored parameter.

5.3 Control

The process of conveying a command or order to enable the desired action to be effected.

5.5 Control System

An assembly of devices interconnected or otherwise coordinated to convey the command or order.

5.7 Automatic Control

A means of control that conveys predetermined orders without action by an operator.

5.9 Instrumentation

A system designed to measure and to display the state of a monitored parameter and which may include one or more of sensors, read-outs, displays, alarms and means of signal transmission.

5.11 Local Control

A device or array of devices located on or adjacent to a machine to enable it to be operated within sight of the operator.

5.13 Remote Control

A device or array of devices connected to a machine by mechanical, electrical, pneumatic, hydraulic or other means by which the machine may be operated remote from, and not necessarily within sight of the operator.

5.15 Monitoring System

A system designed to supervise the operational status of machinery or systems by means of instrumentation, which provides displays of operational parameters and alarms indicating abnormal operating conditions.

5.17 Safety System

To protect an operating machine in the event of a detected fault, the automatic control system may be designed to automatically shutdown the machine.

5.19 Fail-safe

A designed failure state which has the least critical consequence. A system or a machine is fail-safe when, upon the failure of a component or subsystem or its functions, the system or the machine automatically reverts to a designed state of least critical consequence.

5.21 Systems Independence

Systems are considered independent where they do not share components, except common sensors for non-shutdown related systems, such that a single failure in any one component in a system will not render the other systems inoperative.

5.23 Unmanned Machinery Space

Machinery space(s) which can be operated without continuous attendance by the crew locally in the machinery space(s) and in the local centralized control and monitoring station(s) (if provided).

5.25 Local Centralized Control and Monitoring Station

A control station fitted with instrumentation, control systems and actuators to enable machinery to be controlled and monitored without the need of regular local attendance in the machinery space(s).

5.27 Remote Control and Monitoring Center

A location outside the machinery space(s) fitted with means of remote control and monitoring for the machinery and the state of the machinery space(s).

7 Plans and Data

The following plans and data are to be submitted for review, as applicable.

7.1 Specifications

A general description of the operation of the automatic or remote control systems is to be given. This is to include a list of monitoring points, their alarm settings and their normal ranges.

7.3 System Design Plans

7.3.1 Machinery Control Systems

Schematic diagrams and operational descriptions for the following items:

- Control from the local centralized control and monitoring station(s) in or adjacent to the machinery space(s) and remote control and monitoring center outside the machinery space(s), as applicable.
- Independent local control
- Starting of machinery
- Manual Emergency shutdown

7.3.2 Machinery Safety Systems

Operational descriptions for the automatic shutdowns

7.3.3 Machinery Monitoring Systems

Description of the monitoring systems with a list of alarms and displays including preset parameters for the following items, as applicable:

- Local centralized control and monitoring station(s) in or adjacent to the machinery space(s)
- Monitoring station in the engineers' accommodations
- Remote control and monitoring center outside the machinery space(s)

7.3.4 Fire Safety Arrangements

Schematic diagrams and descriptions of the fire detection and alarm systems, fire precautions, fire extinguishing, and fire fighting station arrangements.

7.3.5 Communication Systems

Schematic diagrams and arrangements of internal communication systems between all control and monitoring stations.

7.3.6 Power Supply Arrangements

Schematic diagrams and operational descriptions of power supply to the control, monitoring and safety systems.

7.5 Control Console Plans

Schematic diagrams, parts list (including manufacturer's names and model names), function descriptions, construction plans and outline view of the following equipment, as applicable:

- Local centralized control and monitoring station(s) consoles in or adjacent to the machinery space(s)
- Remote control and monitoring center console outside the machinery space(s)

7.7 Installation Plans

7.7.1 Installation Arrangements

Locations and arrangements of consoles and equipment for the local centralized control and monitoring station(s) in or adjacent to the machinery space(s) and the remote control and monitoring center outside the machinery space(s), as applicable.

7.7.2 Electrical One-line Diagrams

Type, size and protection of cables between control and monitored equipment.

9 General Provisions

9.1 Alarm Systems

Alarm systems are to have the following detailed features.

9.1.1 Characteristics

Alarm systems are to be of the self-monitoring type and designed so that a fault in the alarm system is self-revealing or will cause it to fail to the alarmed condition. Additionally, alarms are not to react to normal transient conditions or false signals.

9.1.2 Independence

Alarm systems are to be, as much as practicable, independent of control and safety systems, except that common sensors will be acceptable for non-shutdown related systems.

9.1.3 Visual and Audible Alarms

Alarms are to be both audible and visual, and are to be provided at the control stations, as listed in Subsection 2/9. Alarms are to clearly identify the system and service of the faulted system or components. Visual alarms are to be displayed in a distinguishable manner such that alarms for similar components or systems are grouped together, and the colors representing a particular function or condition remain uniform. Visual alarms are to flash when first activated. Audible alarms associated with the machinery system or components are to be of a tone distinctive from other alarms such as fire alarm, general alarm, gas detection, etc., and they are to be of sufficient loudness to attract the attention of personnel on duty. For spaces of unusually high noise levels, a beacon light or similar device, installed in a conspicuous place is to supplement any of the audible alarms in such spaces. However, red light beacons are only to be used for fire alarms.

A fault in the visual alarm circuits is not to affect the operation of the audible alarm circuits.

9.1.4 Acknowledgement of Alarms

Alarms are to be acknowledged by manually changing the flashing display of the incoming alarm to a steady display and by silencing the audible signal; the steady state light display is to remain activated until the fault condition is rectified. Alarming of other faults that may occur during the acknowledgement process is not to be suppressed by such action, and is to be alarmed and displayed accordingly. The silencing of the audible alarm from a remote control and monitoring center outside the machinery space(s) is not to lead automatically to the silencing of the original alarm at the local centralized control and monitoring station(s) in or adjacent to the machinery space(s) (if provided).

9.1.5 Disconnection and Resumption of Alarm Functions

Alarm circuits may be temporarily disabled for maintenance purposes or during initial plant start-up, provided such action is clearly indicated at the local centralized control and monitoring station(s) in or adjacent to the machinery space(s), if provided, and at the remote control and monitoring center outside the machinery space(s). However, such an alarm is to be automatically re-activated after a preset time period.

9.1.6 Built-in Testing

Alarm systems are to be provided with effective means for testing of all audible and visual alarms and indicating lamps without disrupting the normal machinery or system operation.

9.3 Automatic Safety Shutdown

To avert rapid deterioration of machinery, the following automatic shutdowns are to be provided, regardless of the mode of control: manual, remote or automatic. Automatic shutdowns are to be completely independent, including sensors, of the control and alarm systems. These shutdowns are not to be fitted with manual override.

- i)* For all diesel engines:
 - Overspeed
- ii)* For all gas fired engines:
 - Malfunction of gas fuel injection or pilot oil fuel injection valves
 - High exhaust gas temperature
 - Low cylinder pressure or ignition failure
 - Overspeed

- iii)* For all gas turbines:
 - Failure of lubricating oil system
 - Failure of flame or ignition
 - High exhaust gas temperature
 - High compressor vacuum
 - Overspeed
 - Excessive vibration
 - Excessive axial displacement of rotors
- iv)* For all steam turbines:
 - Failure of lubricating oil system
 - Overspeed
 - Back-pressure for auxiliary turbines
- v)* For all boilers:
 - Failure of flame
 - Failure of flame scanner
 - Low water level
 - High-high water level (for steam turbines supplying electric power to topside facilities process control systems)
 - Failure of forced draft pressure
 - Failure of control power
 - Detection of gas leakage for gas fuel burning boilers
- vi)* For all electric generators:
 - For generators fitted with forced lubrication system only, shutdown prime movers upon failure of generator lubricating oil system.
- vii)* For all Inert gas generators:
 - Failure of flame
 - High gas temperature
 - Low water pressure-gas scrubber
 - High water level-gas scrubber
 - Failure of gas blower

9.5 Power Supply

Power source for control, monitoring and automatic shutdown systems may be electric, hydraulic or pneumatic or a combination thereof. Loss of control power to any device is not to cause the system to go into an unsafe condition. Failure of the power supply is to be alarmed.

9.7 Fail-safe

A “Fail-safe” concept is to be applied to the design of all remote control systems, manual emergency control systems and automatic shutdown systems.

9.9 Local Controls

Remotely operated machinery is to be provided with effective means of independent local manual controls at or in the proximity to the machinery. Means are to be provided locally to disconnect or override other control stations or to disable automatic control, if provided.

9.11 Control Transfer

Control of the machinery is to be possible only from one location at a time and is to be provided with procedures to ensure proper transfer of control. At each location there is to be an indicator showing which location is in control of the machinery.

9.13 Components

9.13.1 Environmental Considerations

All control, monitoring and safety system components, including alarm and indicator devices, are to be designed for use in a marine environment, resistant to corrosion, and capable of operating under all prevailing environmental conditions. Each component is to be designed and tested for the extremes of pressure and temperature that it can encounter in service.

9.13.2 Suitability of Computer Based Equipment

Where safety related functions are performed by computer based equipment, then this equipment is to be tested in accordance with the requirements of 4-9-7/13.1 of the *Steel Vessel Rules*.

9.13.3 Electrical Variations

Electrical and electronic components in AC systems are to be capable of operating satisfactorily under normally occurring variations in voltage and frequency. Unless otherwise stated, the variations from the rated value may be taken from [Section 1, Table 1](#) below. DC system devices are to be capable of operating satisfactorily at minus 15% voltage.

**TABLE 1
Electrical Variations**

<i>Quantity in Operations</i>	<i>Permanent Variation</i>	<i>Transient Variation</i>
Frequency	±5%	±10% (5s)
Voltage	+6%, -10%	±20% (1.5s)

9.13.4 Approved Component

Those products ABS Type Approved under [1-1-A3/5 of the ABS Rules for Conditions of Classification – Offshore Units and Structures \(Part 1\)](#) and listed will be acceptable without the need for the Surveyor's attendance for production tests and inspections subject to renewal and updating of the type approved certificates as specified in [1-1-A3/5 of the ABS Rules for Conditions of Classification – Offshore Units and Structures \(Part 1\)](#).

9.15 Installation

9.15.1 Electrical Installations

Electrical installations for control, monitoring and safety systems are to be in accordance with Chapter 3, Section 6 of the *Facilities Guide* and Part 4, Chapter 8 of the *Steel Vessel Rules*, as applicable.

9.15.2 Hydraulic and Pneumatic Control Systems

Piping systems for hydraulic and pneumatic controls are to be in accordance with Chapter 3, Section 4 of the *Facilities Guide* and Part 4, Chapter 6 of the *Steel Vessel Rules*, as applicable.

9.17 Testing

All equipment is to be performance tested in the presence of the Surveyor in accordance with 1/9.13.3 in the shop or after installation. All installations are to be functionally tested to the satisfaction of the Surveyor on board and during sea trial.



SECTION 2 AMCC Notation

1 Application

Where, in lieu of manning the machinery space(s) locally, it is intended to control or monitor the machinery/systems, as listed in Subsection 1/1, under continuous supervision from a local centralized control and monitoring station(s), the provisions of Subsection 1/9 and Section 2 are to be complied with.

3 Local Centralized Control and Monitoring Station(s)

The local centralized control and monitoring station(s) is to be located within or adjacent to the machinery space(s) so that control or monitoring of the machinery will be as effective as it would be under local supervision. Where this station(s) is in an enclosure located in or adjacent to the machinery space(s), at least two means of access, separate and remote from each other as far as practicable, are to be provided. Where fitted, glass windows forming parts of the boundaries are to be of the shatter resistant type (e.g. laminated glass or wire meshed embedded glass).

5 Monitoring in Local Centralized Control Station(s)

Alarms, and displays for machinery are to be provided in the local centralized control and monitoring station(s) as specified in Subsection 2/9, as applicable.

7 Engineer's Alarm

Where alarms are not acknowledged at the local centralized control and monitoring station(s) in a pre-set period of time (e.g. 2 minutes), the system is to activate the engineer's alarm audible in the engineers' accommodations.

9 Instrumentation of Machinery

9.1 Oil Fired Boilers

Alarms, displays and automatic shutdowns in Section 2, Table 1 are applicable.

The requirements in 4-4-1/11 of the *Steel Vessel Rules* are also to be complied with, as applicable.

TABLE 1
Oil Fired Boilers

<i>System</i>		<i>Alarm</i>	<i>Display</i>	<i>Automatic shut-down fuel oil supply with alarm</i>	<i>Notes</i>
Boiler drum water level	A1	Low		Low-low	
	A2	High		High-High *	*see foot note
Feed water outlet salinity	B1	High	Salinity level		
Forced draft fan-air pressure	C1			Low	
Steam pressure	D1		Pressure		
	D2	High			
	D3	Low			
Super heater outlet temperature	E1		Temperature		
	E2	High			
Burner flame	F1			Failure	
Burner flame scanner	F2			Failure	
Air supply casing	F3	Fire			
Uptake gas temperature	F4	High			
Atomizing medium	G1	Off-limit condition			
Fuel oil valve	H1		Open/close		Applicable for individual valves of multiple burners.
Fuel oil pressure	H2		Pressure		
Fuel oil temperature (or viscosity)	H3	Low-pressure			
	H4	High (or low)			For heavy fuel oil only
Fuel oil service tanks level	H5	Low			
	H6	High			If automatic filling is provided
Overflow tank and drain tank level	H7	High			
Fuel tank oil temperature	H8	High			If heating arrangements are fitted.
Power supply to control system	I1	Failure	Available		

* Note: Where boiler supplies steam to generator turbines feeding electric source to topside facilities including monitoring and control systems, automatic shut-down should be activated at high-high water level in order to prevent damage of turbine due to carry-over of water.

9.3 Incinerators

Alarms, displays and automatic shutdowns in Section 2, Table 2 are applicable.

**TABLE 2
Incinerators**

<i>System</i>		<i>Alarm</i>	<i>Display</i>	<i>Automatic shut-down fuel oil supply with alarm</i>	<i>Notes</i>
Air supply pressure	A1			Low	
Air supply fan motor	A2		Motor running		
Fuel oil pressure	B1	Low	Pressure		
Fuel oil pump	B2		Running		
Fuel oil temperature (viscosity)	B3		Temperature (Viscosity)		For heavy fuel oil only
	B4	High (Low)			
	B5	Low (High)			
Burner valve	C1		Open/close		Applicable for individual valves of multiple burners
Burner flame	C2		Ignited	Flame failure	
Furnace temperature	C3			High	
	C4	Low			
Flue gas temperature	C5			High	
Power supply to control system	D1	Failure	Available		

9.5 Waste Heat Boilers

Alarms, displays and automatic shutdowns in Section 2, Table 3 are applicable.

**TABLE 3
Waste Heat Boilers**

(not designed to operate with low water level)

<i>Monitored Parameter</i>		<i>Alarm</i>	<i>Notes*</i>
<i>Smoke tube type</i>			
A1	Boiler drum water level – low	x	4-4-1/11.7.1(a)
B1	Exhaust gas automatic diversion	x	4-4-1/11.7.1(a)
C1	Exhaust gas temperature at outlet – high	x	4-4-1/11.5.2(b)
<i>Water tube type</i>			
D1	Water flow in the tubes – low	x	4-4-1/11.7.1(b)
E1	Exhaust gas temperature at outlet – high	x	4-4-1/11.5.2(b)

* “Notes” refers to the paragraph numbers of the *Steel Vessel Rules*.

9.7 Fired Water Heaters

Alarms, displays and automatic shutdowns in Section 2, Table 4 are applicable.

**TABLE 4
Fired Water Heaters**

<i>Monitored parameter</i>		<i>Alarm</i>	<i>Automatic Shut-down with Alarm</i>	<i>Notes*</i>
A1	Heater water level – low	x		4-4-1/11.5.1(b)
A2	Heater water level – low-low		x	4-4-1/11.9 [4-4-1/11.5.1(b)]
A3	Heater water level – high	x		4-4-1/11.5.1(b)
B1	Forced draft fan – failure		x	4-4-1/11.9 [4-4-1/11.5.1(c)]
B2	Air supply casing – fire	x		4-4-1/11.5.2(b)
C1	Burner flame – failure		x	4-4-1/11.9 [4-4-1/11.5.1(a)]
C2	Flame scanner – failure		x	4-4-1/11.9 [4-4-1/11.5.1(a)]
D1	Atomizing medium – off limit condition	x		4-4-1/11.9 [4-4-1/11.5.3(e)]
E1	Uptake gas temperature – high	x		4-4-1/11.5.2(b)
F1	Control power supply – loss		x	4-4-1/11.9 [4-4-1/11.5.1(d)]

* “Notes” refers to the paragraph numbers of the *Steel Vessel Rules*.

9.9 Fired Thermal Oil Heaters

Alarms, displays and automatic shutdowns in Section 2, Table 5 are applicable.

**TABLE 5
Fired Thermal Oil Heaters**

<i>Monitored parameter</i>		<i>Automatic Shut-down with Alarm</i>	<i>Notes*</i>
A1	Burner flame – failure	x	4-4-1/13.3.3 [4-4-1/11.5.1(a)]
A2	Flame scanner – failure	x	4-4-1/13.3.3 [4-4-1/11.5.1(a)]
B1	Forced draft system – failure	x	[4-4-1/11.5.1(c)]
C1	Control power supply – loss	x	[4-4-1/11.5.1(d)]
D1	Thermal oil expansion tank level – low	x	4-4-1/13.3.3
D2	Thermal oil temperature at oil outlet – high	x	4-4-1/13.3.3
D3	Thermal oil pressure or flow in circulation system – low	x	4-4-1/13.3.3
E1	Flue gas temperature – high	x	4-4-1/13.3.3

* “Notes” refers to the paragraph numbers of the *Steel Vessel Rules*.

9.11 Exhaust Gas Thermal Oil Heaters

Alarms, displays and automatic shutdowns in Section 2, Table 6 are applicable.

TABLE 6
Exhaust-gas Thermal Oil Heaters

<i>Monitored parameter</i>		<i>Alarm</i>	<i>Automatic Shut-down with Alarm</i>	<i>Notes*</i>
A1	Thermal oil expansion tank level – low		x	4-4-1/13.5 (4-4-1/13.3.3)
A2	Thermal oil temperature at oil outlet – high		x	4-4-1/13.5 (4-4-1/13.3.3)
A3	Thermal oil pressure or flow in circulation system – low		x	4-4-1/13.5 (4-4-1/13.3.3)
B1	Exhaust gas temperature – high	x		4-4-1/13.5 ii)

* “Notes” refers to the paragraph numbers of the *Steel Vessel Rules*.

9.7 Crude Oil or Slops Burning Boilers

In addition to the requirements in Section 2, Table 1, alarms and displays in Section 2, Table 7 are also applicable.

TABLE 7
Crude Oil or Slops Burning Boilers

<i>System</i>		<i>Alarm</i>	<i>Display</i>	<i>Notes*</i>
Vent hood exhaust fan	A1	Failure	Running	6.0
Vent hood stand-by exhaust fan	A2		Running	6.0
Drain tank level	A3	High		8.0
Crude oil tank and slop tank oil temperature	A4	High		9.0
Boiler compartment ventilation fan	A5	Failure	Running	12.0
Gas detection for pipe ducts, vent hoods.	A6	Gas leakage		13.0
Remote control shut-off valves	A7		Open/close	8.0
I.G. pressure in pipe duct	A8	Low		7.0
Power supply to control system	A9	Failure	Available	

* “Notes” refers to the section numbers of the *ABS Guide for Burning Crude oil and Slops in Main and Auxiliary Boilers*.

9.15 Inert Gas System

9.15.1 Inert Gas Generators

Alarms, displays and safety shutdowns in Section 2, Table 8 are applicable.

The requirements in 5C-1-7/25.29 through 5C-1-7/25.37 of the *Steel Vessel Rules* are also to be complied with, as applicable.

TABLE 8
Inert Gas Generators

<i>System</i>		<i>Alarm</i>	<i>Display</i>	<i>Automatic shut-down fuel oil supply with alarm</i>	<i>Notes</i>
Air supply pressure	A1	Low			
Air supply fan motor	A2		Motor running		
Fuel oil pressure	B1	Low	Pressure		
Fuel oil pump	B1		Running		
Fuel oil temperature (viscosity)	B3		Temperature (Viscosity)		For heavy fuel oil only
	B4	High (Low)			
	B5	Low (High)			
Burner valve	C1		Open/close		Individual valves applicable only for multiple burners
Burner flame	C2		Ignited	Flame failure	
Combustion chamber	C3	Excessive smoke	Smoke		
Inert gas pressure	D1	Low	Pressure		Alarm at pressure less 100 mm water gauge
	D2	High			
Inert gas temperature	D3			High	
Inert gas oxygen	D4	High content (8%)	Content		
Gas scrubber – water pressure (or flow)	E1			Low	Also, automatic shutdown of I.G. blower and Gas regulating valve
Gas scrubber – water level	E2			High	Also, automatic shutdown of I.G. blower and Gas regulating valve
Gas blower	F1			Failure	Also, automatic shutdown of Gas regulating valve
Gas regulating valve – power supply	G1	Failure	Available		
Power supply to generator	H1	Failure	Available		
Power supply to automatic control system	H2	Failure	Available		

9.15.2 Nitrogen Generator Inert Gas System

Alarms and displays in Section 2, Table 9 are applicable. The requirements in 5C-1-7/25.41.5 and 5C-1-7/25.41.6 of the *Steel Vessel Rules* are also to be complied with, as applicable.

TABLE 9
Nitrogen Generator Inert Gas System

<i>System</i>		<i>Alarm</i>	<i>Display</i>	<i>Notes</i>
Gas pressure	A1	Low	Pressure	Alarm at pressure less 100 mm water gauge
	A2	High		
Inert gas oxygen	B1	High Content (8%)	Content	
Gas regulating valve – power supply	C1	Failure		
Power supply to control system	D1	Failure	Available	

9.17 Steam Turbines

Alarms, displays and safety shutdowns in Section 2, Table 10 are applicable.

TABLE 10
Steam Turbines

<i>System</i>		<i>Alarm</i>	<i>Display</i>	<i>Automatic shut-down with alarm</i>	<i>Notes</i>
Lube oil inlet pressure	A1	Low	Pressure	Low-low	
Lube oil inlet temperature	A2	High	Temperature		
Lube oil gravity tank	A3		Low level		
Bearing temperature	B1	High	Temperature		
Cooling water pressure or flow	C1	Low	Pressure or flow		
Cooling water temperature	C2	High	Temperature		
Cooling water expansion tank level	C3	Low			
Sea water pressure or flow	D1	Low	Pressure or flow		Automatic start of sea water cooling pump. See footnote*
Steam pressure inlet	E1	Low	Pressure		
Condenser vacuum	F1	Low	Pressure		
Condenser pump	F2	Failure	Motor running		
Rotor	G1	Axial displacement			Multi stage turbines
Turbine speed	G2			Overspeed	
Power supply to control system	H2	Failure	Available		

* Note: Where generator turbines are used for feeding electric source to topside facilities and the relevant monitoring and control system, the standby sea water cooling pump is to be automatically started at low pressure or low flow.

9.19 Gas Turbines

Alarms, displays and safety shutdowns in Section 2, Table 11 are applicable.

TABLE 11
Gas Turbines

<i>System</i>		<i>Alarm</i>	<i>Display</i>	<i>Automatic shut-down with alarm</i>	<i>Notes</i>
Lube oil inlet pressure	A1	Low	Pressure	Low-low	
Lube oil inlet temperature	A2	High	Temperature		
Bearing temp. or oil outlet temp	A3	High	Temperature		
Lube oil filter	A4	Different pressure			
Cooling water pressure or flow	B1	Low	Pressure or flow		
Cooling water temp.	B2	High			
Fuel oil inlet pressure	C1	Low	Pressure		
Fuel oil temperature (or viscosity)	C2	High (Low)			For heavy fuel oil only
Exhaust gas temp.	D1.	High			
Combustion (flame)	E1			Failure	
Starting ignition	F1			Failure	
Stored starting energy level	F2	Low			
Turbine vibration level	G1			High	
Turbine axial displacement	G2			High	Auto shutdown may be omitted for rotors fitted with roller bearing
Turbine speed	G3			Overspeed	
Vacuum at compressor inlet	H1			High	
Power supply to control system	I1	Failure	Available		

9.21 Diesel Engines

Alarms, displays and safety shutdowns in Section 2, Table 12 are applicable.

TABLE 12
Diesel Engines (2009)

<i>System</i>		<i>Alarm</i>	<i>Display</i>	<i>Automatic shut-down with alarm</i>	<i>Notes</i>
Lube oil inlet pressure	A1	Low	Pressure	Low-low	
Lube oil inlet temperature	A2	High	Temperature		
(2009) Oil mist in crankcase, mist concentration – high; or Bearing Temperature – high; or Alternative arrangements	A3	(2009) High		(2009) High for AMCCU. (Not mandatory for AMCC).	(2009) For engines having a power of 2250 kW (300 hp) and above or cylinder bore of more than 300 mm (11.8 in.). Single sensor having two independent outputs for initiating alarm and for shutdown will satisfy independence of alarm and shutdown. See 4-2-1/7.2 of the <i>Steel Vessel Rules</i> .
Cooling water pressure or flow	B1	Low	Pressure or flow		
Cooling water temp.	B2	High	Temperature		
Expansion tank level	B3	Low			
Fuel oil injection pipe	C1	Leakage			
Fuel oil temperature (or viscosity)	C2	High (Low)			For heavy fuel oil only
Fuel oil service tank level	C3	Low			
Starting medium energy level	D1	Low	Energy level		
Speed	E1			Overspeed	
Power supply to control system	F1	Failure	Available		

9.23 Hazardous Liquid Handling Machinery/Systems

The requirements in this subsection are applicable to hazardous liquid cargo handling machinery for crude oil, liquefied gases and chemical cargo in bulk.

Alarms in Section 2, Tables 13 and 14 are applicable.

TABLE 13
Ballast Machinery/Systems in Pump Room

<i>System</i>		<i>Alarm</i>
Pump bearing temperature	A1	High
Pump casing temperature	A2	High
Pump room bulkhead gland temperature	A3	High

TABLE 14
Cargo Machinery/Systems

<i>System</i>		<i>Alarm</i>	<i>Display</i>	<i>Notes</i>
Pump bearing temperature	B1	High		
Pump casing temperature	B2	High		
Pump room bulkhead gland temperature	B3	High		
Pump discharge pressure	B4	Pressure		
Tank pressure		Over/under pressure		If pressure sensors are fitted
Tank level		High		If fitted
Tank valve	C1		Open/close	

9.25 Use of Cargo as Fuel

Where methane (LNG) is utilized in boilers, inert gas generators, combustion engines and gas turbines, the alarms and displays in Section 2. Tables 15 and 16 are applicable in addition to the requirements in Section 2, Tables 1, 8, 11 and 12.

The requirements in Section 5C-8-16 of the *Steel Vessel Rules* are also to be complied with, as applicable.

TABLE 15
Cargo as Fuel

<i>System</i>		<i>Alarm</i>	<i>Display</i>	<i>Notes*</i>
Master valve	A1	Automatic close		5C-8-16/3.7
Automatic gas fuel valves	A2	Automatically closed		5C-8-16/3.6
Vent valve	A3	Automatically opened		5C-8-16/3.6
Gas supply pressure	B1	High		
	B2	Low		
Fuel type	C1		Oil/Gas	
Concentric fuel piping – IG pressure	D1	Low		If I.G. system is provided.
Machinery space – ventilation fan	E1	Failure	Running	5C-8-16/2.1
Concentric fuel piping – ventilation fan	E2	Failure	Running	If mechanical exhaust ventilation system is provided. 5C-8-16/3.1.2
Ventilation hood or casing – ventilation fan	E3	Failure	Running	If not served by mechanical exhaust ventilation system required in 5C-8-16/3.1.2. 5C-8-16/3.4
Gas detection for 1) Gas ducts and ventilation hoods, 2) Machinery space and 3) Ventilation hood or casing.	F1	Lower flammable limit		5C-8-16/2.2, 5C-8-16/3.1.2 5C-8-16/3.4
Degassing tank	G1	Presence of gas		5C-8-16/4.3

* “Notes” refers to the paragraph numbers of the *Steel Vessel Rules*.

TABLE 16
Gas fired Internal Combustion Engine

<i>System</i>		<i>Alarm</i>	<i>Display</i>	<i>Notes*</i>
Crankcase oil mist	A1	High		For trunk piston type engine. 5C-8-16/11.1
Crankcase gas	A2	Presence of gas		
Crankcase oil mist (or bearing temp.)	A3	High		For Crosshead type engine. 5C-8-16/11.1
Piston underside space gas detection	B1	Presence of gas		
Gas fuel injection (or pilot oil fuel injection valves)	C1	Malfunction		5C-8-16/12.2
Exhaust gas temperature at each cylinder outlet	D1	High		5C-8-16/12.2
	D2	Deviation from average		
Cylinder pressure (or ignition failure) of each cylinder	E1	Low (Failure)		
Power supply to control system	F1	Failure	Available	

* "Notes" refers to the paragraph numbers of the *Steel Vessel Rules*.

9.27 Electric Power Generating Plant

Alarms and displays in Section 2, Table 17 are to be provided at the local centralized control station.

TABLE 17
Electric Power Generating Plant

<i>System</i>		<i>Alarm</i>	<i>Display</i>	<i>Notes</i>
Generator	A1	Failure	Running	
Voltage	A2	High/low	Volt	
Current	A3	High	Amp.	
Frequency	A4	High/Low	Hz	
Bearing lube oil inlet pressure	A5	Low	Pressure	Automatic shutdown prime mover
Generator cooling inlet pump or fan motor	A6	Failure		
Generator cooling medium temp.	A7	High	Temperature	
Equipment-earth fault	B1	Earth fault		For high voltage system
Stationary windings temperature	B2	High		For high voltage rotating machine
Water cooler leakage	B3	Leakage		For high voltage rotating machine
Phase to phase internal fault or earth fault	B4	Fault		For high voltage power transformer

9.29 Fuel Oil System

The requirements in this subsection are applicable to fuel oil tanks provided with heating arrangements, and fuel oil heaters.

Alarms and displays in Section 2, Table 18 are applicable.

**TABLE 18
Fuel Oil Systems**

<i>System</i>		<i>Alarm</i>	<i>Display</i>	<i>Notes*</i>
Settling and service tank level	A1	High/Low		High level alarm required only if automatic filling is provided.
Overflow tank and drain tank level	B1	High		
Transfer pump start/stop	C1		Status	
Heated fuel oil in settling and service tank-temperature	D1	High	Temperature	4-6-4/13.5.7
Fuel oil tank, fluid heating medium-temperature	E1	High		4-6-4/13.5.7
Fuel oil heater, fuel oil temperature (or viscosity)	F1	High (or low)		4-6-4/13.7.4
Fuel oil heater, fluid heating medium-temperature	F2	High		

* "Notes" refers to the paragraph numbers of the *Steel Vessel Rules*.

11 Machinery Space Monitoring

11.1 Bilge Level and Fire Monitoring

Alarms and displays in Section 2, Table 19 are applicable for protection against flooding and fire in machinery space.

**TABLE 19
Bilge and Fire Systems**

<i>System</i>		<i>Alarm</i>	<i>Display</i>
Machinery space bilge level	A1	High	
Bilge pump running	A2	Excessive running	Running
Machinery space fire	B1	Fire	



SECTION **3** **AMCCU Notation**

1 **Application**

Where it is intended that the machinery space(s) and the machinery local centralized control and monitoring station(s) (if provided) be periodically unmanned and that the machinery, as listed in Subsection 1/1, be controlled and monitored from a remote control and monitoring center, the provisions of Subsection 1/9, Section 2 and Section 3 are to be complied with.

3 **Duration of Unattended Operation**

The extent of automation, monitoring and remote control is to be such as to allow unattended machinery space(s) operation for at least 24 hours. Otherwise, a time limitation will be noted in the classification records.

5 **Remote Control and Monitoring Center**

A remote control and monitoring center is to be provided, and it is to be located outside the machinery space(s).

Alarms for all machinery specified in Subsection 2/9, as applicable, are to be provided at the remote control and monitoring center.

7 **Monitoring Station in the Engineers' Quarters**

At least one alarm monitoring station is to be provided in the engineers' public space. In addition, an alarm monitoring station is to be provided in each engineer's cabin through a selector switch so arranged as to ensure connection to at least one of these cabins. Each station is to be provided with:

- An alarm for fire in the machinery space(s)
- An alarm for high bilge water level in the machinery space(s); and
- A summary alarm to be activated by any of the alarm conditions listed in Subsection 2/9.

The fire alarm is to have a separate visual display and a distinct sound from the summary alarm and any other fitted alarms. A selector switch is not to be provided for the fire alarm.

9 **Fire Fighting Station**

A fire fighting station is to be provided and it is to be located outside the machinery space(s). The fire fighting station is to be provided with remote manual controls for the operations detailed in the following list, as applicable:

- Shutdown of ventilation fans serving the machinery space(s).
- Shutdown of oil fuel oil units
- Shutdown of forced draft blowers of boilers, inert gas generators and incinerators.
- Closing of machinery space(s) fuel oil tanks' suction valves.
- Closing of master valve in gas fuel supply system.
- Closing of machinery space skylights, opening in funnels, ventilator dampers, and other openings
- Closing of machinery space fire-tight doors. Doors normally closed and self-closing doors may be excluded.
- Starting of emergency generator where it is not arranged for automatic starting.
- Starting of fire pump located outside the machinery space(s), including operation of all necessary valves, to pressurize the fire main
- Actuation of the fixed fire extinguishing system for the machinery space(s).

11 Fire Detection and Alarm Systems

11.1 General

Machinery space(s) are to be provided with a fixed fire detection and alarm system complying with 4-7-2/1.15 of the *Steel Vessel Rules*. This fixed fire detection and alarm system may be combined with other fire detection and alarm systems required on board the vessel. The fire control panel is to be located in the remote control and monitoring center or in the fire fighting station. If located in the fire fighting station, a repeater panel is to be fitted in the remote control and monitoring center.

11.3 Fire Alarm Call Points

Manually operated fire alarm call points are to be provided at the remote control and monitoring center and passageways leading to the machinery space(s).

13 Interior Communication System

A common talking means of voice communication and calling is to be provided among the local centralized control and monitoring station(s) (if provided), remote control and monitoring center and engineers' monitoring station. Simultaneous talking among these locations is to be possible at all times and the calling to these locations is to be always possible even if the line is busy.